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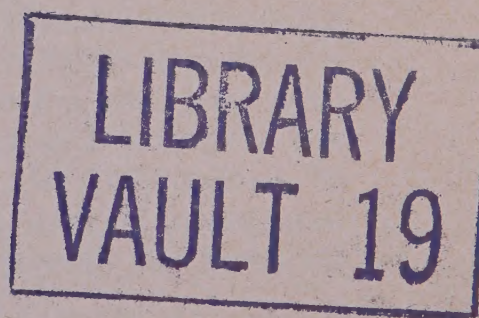
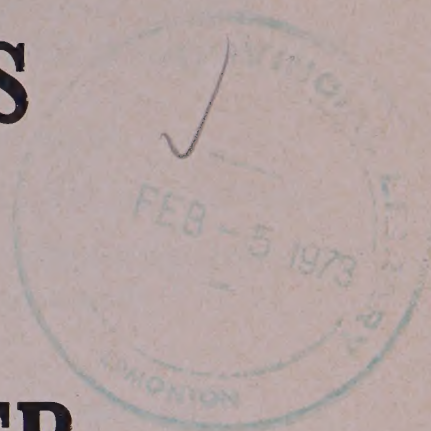
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Methods of Fertilizer Application.

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METHODS OF FERTILIZER APPLICATION



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ACKNOWLEDGEMENTS

Dr. W. B. Reed, University of Saskatchewan for providing much of the material on application equipment.

Publications Available From:

Publications Office, Extension Service,
Alberta Department of Agriculture, Edmonton
or your District Agriculturist.

Methods of Fertilizer Application

Prepared by Soils Branch, Plant Industry Division

The need to use different methods of applying fertilizer to crops are:

- (1) To place fertilizer where it will do most good.
- (2) Place uniformly in drill row or evenly over soil surface.
- (3) Apply fertilizer most economically, considering costs and convenience (time, labor and capital involved).

Chemical Characteristics Determine Methods of Application

To obtain maximum returns from your fertilizer dollar, you should know something about the plant nutrients themselves. The four major plant nutrients applied in Alberta are listed below:

Nitrogen — Nitrogen may be in three forms, ammonia, nitrate and urea. The ammonia and urea convert readily to the nitrate form under warm soil conditions. If the soil is wet and cold, the conversion is slow or stopped. Urea and nitrate are very soluble and mobile. Ammonia is not very mobile but readily converts to nitrate under warm, moist soil conditions. Nitrogen can be applied in the row or on the surface and worked into the soil by cultivation. Nitrogen fertilizer may be applied in the fall, early spring or during seed bed preparation. It is best, when fertilizer is broadcast or sprayed on the surface, to incorporate or work the fertilizer into the soil after application. Nitrogen may be drilled in the seed row, however, too much will injure the germinating seedlings. The maximum rates that can be safely drilled in are: (i) Cereals — 25 pounds N per acre (dry seed bed) to 30 lbs./acre, N (moist seed bed) and (ii) small seeds (flax, mustard, rapeseed) 10-12 pounds N per acre.

Phosphate — Phosphate or phosphorus fertilizer **does not** move readily in the soil, therefore it is most effective when placed within easy reach of the roots. It is best to drill phosphate fertilizer near the seed for annual crops. Phosphate applications on perennial forage crops should be applied in late fall or early spring. Since phosphate moves slowly, delayed responses to application on forage crops may be noticed.

Potash — This nutrient's mobility in soil is somewhat similar to that of phosphate, therefore, it should be applied in the seed row at planting time of annual crops. For cereals, no more than 30 pounds of potash should be placed with the seed as germination of cereals may be affected.

Sulphur — Sulphur in fertilizer is generally readily available to plants and may be applied as a broadcast or drill treatment. The most common method of supplying a sulphur requirement is to use a fertilizer such as 21-0-0 (24% S), 16-20-0 (14% S) or 34-0-0 (11% S) which contains a significant amount of sulphur. Sulphur may also be broadcast as elemental sulphur (flowers of sulphur) or as gypsum at higher rates (50 to 60 pounds per acre) every 4 to 6 years. Good incorporation is required after application of elemental sulphur to allow for the conversion of the sulphur to available forms by micro-organism activity.

FORMS OF FERTILIZERS

- (1) **Nitrogen** — Nitrogen is available as a dry granular, liquid solution or gaseous materials. All forms have been found to be equally effective at equal amounts of nitrogen. The granular forms include: Ammonium-sulphate (21-0-0) (14% S), Ammonium Nitrate (33.5-0-0, 34-0-0) Urea-sulphate mixture (34-0-0) (11% S) and Urea (45-0-0, 46-0-0).

Solution fertilizers are available as 28-0-0 and 32-0-0.

Gaseous — Anhydrous Ammonia (82-0-0) is a gaseous form of nitrogen. This material is a liquid under pressure and a gas when released.

- (2) **Phosphate, Potash, Sulphur** — These plant nutrients are presently available only as granular materials.

APPLICATION EQUIPMENT

A seed drill fertilizer attachment is recommended for placing fertilizer in with the seed. Fertilizer should **NOT** be placed in the seed drill box as it will affect the seeding rate and may cause corrosion of the seed drill mechanism.

Since phosphorus must be applied in the drill row at planting time of annual crops, a farmer must have a fertilizer attachment on the planting implement. Where nitrogen requirements are below safe drill-in rates, it is desirable to apply N with the seed. In the drier areas (brown, dark brown and thin black zones) it is recommended that the nitrogen and phosphorus be drilled in at seeding time for most efficient

use of these nutrients. The farmer does have some alternatives to applying nitrogen fertilizer where requirements are above 30 pounds of nitrogen per acre. These are:

- (i) owning an applicator, be it a cyclone or spinner type spreader, dribble type spreader, mounting a regular attachment on a cultivator, liquid fertilizer sprayer or anhydrous ammonia applicator.
- (ii) renting any of the above equipment from fertilizer dealers or neighbors.
- (iii) having a fertilizer dealer supply equipment and fertilizer and the farmer using his own tractor.
- (iv) having fertilizer custom spread by a fertilizer dealer.

HOW TO CHOOSE FERTILIZER APPLICATION EQUIPMENT

The following comments apply to both fertilizer attachments on seed drills and spreading equipment applicators.

- (1) Uniformity of Application. This is difficult to determine until it is field tested. Usually adjustments to equipment can be made in the field. It is advisable that spreading equipment be tested to check if all mechanisms are operating properly.
- (2) Maximum Application Rate. A fertilizer attachment or spreader should provide a wide range of rates and have a maximum rate greater than the highest rate you anticipate using. Attachments should be able to apply up to 150 lbs. of fertilizer per acre, broadcast equipment should apply up to 300 pounds per acre.
- (3) Adjustment of Rate. The mechanism for changing application rate should be easily adjusted and provide for accurate setting.
- (4) Size of Box. The fertilizer attachment box should be large enough so that at the highest rate, it will not empty before the seed drill box. If this is not feasible, then the attachment should at least be large enough so that it must be filled only once between grain box fillings. To determine fertilizer box size to suit a particular drill, use this formula:

Size of Fertilizer Box
(lbs/foot)

=

Fertilizer Rate
(lbs/acre)

×

Grain box size (bu/ft)

Seeding rate (bu/acre)

- (5) Weatherproofing. The box should be weatherproofed so rain or snow cannot enter, materials cake and are corrosive when moisture is allowed into them.

- (6) Corrosion Resistance. The box and metering mechanism should be made of corrosion resistant material.
- (7) Ease of Cleaning. The fertilizer box should be designed so that it can be easily cleaned out.
- (8) Type of Drive. Most fertilizer attachments have a ground drive so that the application rate will remain constant when the rate of travel is changed.
- (9) Cost. Fertilizer attachments cost between \$21 and \$28 per foot of width or \$375 to \$420 for a fifteen foot attachment. Fertilizing 500 acres per year, application costs would be approximately \$0.14 per acre per year.

(Including interest on capital investment and maintenance costs).
(see discussion of costs under various types of equipment).
- (10) Other Uses. There is at least one fertilizer attachment made for use on both a seed drill and cultivation equipment such as a cultivator or discer. This would allow nitrogen fertilizer application during fall or spring cultivation operations.

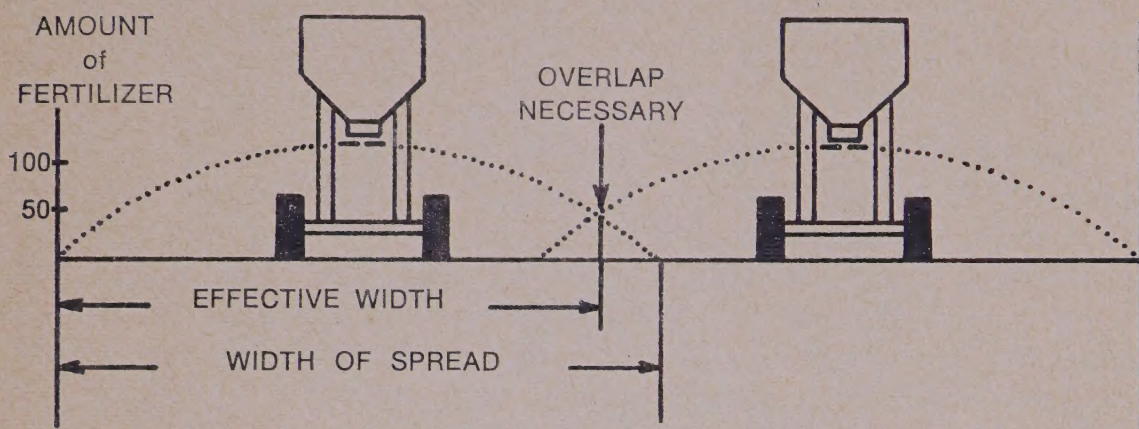
BROADCAST SPREADERS FOR GRANULAR FERTILIZER APPLICATION

There are two principal types of broadcast spreader: the dribble type and the spinner type. The dribble type is similar to seed drills. Some dribble type spreaders are self-contained units mounted on wheels and can be folded for road transport. A fertilizer attachment mounted on tillage implements such as heavy duty cultivators is also an effective broadcast method. As indicated above, at least one attachment is specifically designed for use on both a seed drill and tillage implement.

The spinner or cyclone type spreader has one or two spinner pans. Fertilizer is dropped onto the whirling pan(s) by a ground driven conveyor chain. The whirling discs are driven by the tractor power-take-off. The uniformity of application with this type of spreader can vary considerably. This depends on machine setting, correct overlap, machine bounce and wind conditions. Generally, spinner applications do not distribute fertilizer as evenly as dribble spreaders.

Overlap — Check the spread pattern. Usually less fertilizer is applied on outside edges of spread pattern. Thus it is necessary to overlap to obtain uniform application. If one side delivers more fer-

tilizer than the other, (common with single spinner machines) spreader should be operated around the field rather than back and forth.



TYPICAL SPREAD PATTERN OF A SPINNER TYPE SPREADER

COST OF APPLICATION

Spinner spreaders vary in price from \$850 for small units to \$1,700 for a four ton size trail type unit. These machines often have a relatively short life due to the corrosive nature of fertilizer.

To be economic, the machine must be used to cover sizeable acreage each year, e.g. with a machine that costs \$1,000 and would last 10 years —

If used on 1,000 acres each year, approximate cost per acre -- 15c

If used on 500 acres each year, approximate cost per acre -- 30c

If used on 250 acres each year, approximate cost per acre -- 60c

(Cost of ownership - \$1,000 capital investment for 10 years at 5% interest is included).

Many fertilizer dealers lease applicators for approximately \$15-\$20 per day. Spreading 150 acres per day, this amounts to 10-13c per acre. Work in North Dakota has shown that farmer-owned application equipment had to cover 1,000 to 1,200 acres per year to reduce the cost per acre to be competitive with rental costs. Custom application was less costly than equipment ownership when less than 450 acres were spread annually.

APPLICATION OF LIQUID AND GASEOUS FERTILIZERS

Nitrogen is available also as liquid or gaseous forms. These forms are as effective and as economic as the granular forms. The gaseous and liquid forms have some advantages over granular forms. Generally, they can be mechanized for easier handling than granular fertilizer. Specialized application equipment is required. The liquid solutions and gaseous materials allow for more uniform application when proper equipment is used.

Regular herbicide boom sprayers can be converted to apply solution fertilizers. The fertilizer material is very corrosive. Therefore, all the copper, brass and zinc parts found in most field sprayers must be replaced with aluminum or stainless steel. Conversion kits are available for some sprayers at a cost of approximately \$200. Purchasing a new sprayer suitable for nitrogen solution application would involve an additional cost of approximately \$150.

ANHYDROUS AMMONIA APPLICATION

Anhydrous ammoniam application requires relatively specialized and expensive equipment. To be economic, cost must be spread over large acreages. Therefore, most anhydrous ammonia is applied by commercial distributors or in a few cases, equipment owned by local farm co-ops. On this basis, anhydrous ammonia can be a convenient and economic source of nitrogen.

Losses may occur during application if the soil is very dry and cloddy. Under normal conditions losses are not significant.

Anhydrous ammonia should be applied to land which has been worked once, preferably twice and should be placed at four to five inches into moist soil.

HANDLING AND STORAGE OF BULK FERTILIZERS ON THE FARM

This topic is discussed in a publication entitled Handling and Storage of Bulk Fertilizers available from your District Agriculturist or Publications Office, Alberta Department of Agriculture, Edmonton.